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RADIOGRAPHIC EVALUATION OF BLUNT RENAL TRAUMA

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Radiographic evaluation was performed on 18 patients with blunt renal trauma. Of 18 patients 11 had minor injury. Four of 11 patients with minor injury had a normal intravenous pyelogram (IVP), and other 7 were confirmed to have minor renal injury by computed tomographic (CT) scan. Seven patients had major injury. Six patients were diagnosed by both IVP and CT, and five by angiography.

CT scan was reliable in major injury and had the high staging accuracy. Angiography was useful in specific patients. Therefore, we conclude that IVP or CT scan should be performed as the initial evaluation, and CT scan or angiography might be used as the second examination in selected patients.

Key words: Blunt renal trauma, Radiographic evaluation, High-dose infusion pyelography, Computerized tomography, Renal angiography

INTRODUCTION

All patients with trauma to the back, flank, lower chest, or abdomen are candidates for renal injury. In Japan, blunt abdominal trauma is the most common etiology of renal trauma. Renal injury due to penetrating abdominal trauma is rare in Japan, accounting for only 1~3% of all renal injuries[1,2]. In our institution, we have experienced no renal injuries due to penetrating abdominal trauma.

Appropriate therapy of blunt renal trauma depends on the accurate and complete assessment of the injury. The choice of managements between immediate exploration and observation must be based to a large extent on information derived from imaging studies including a high-dose infusion pyelography, CT scan and angiography. These provide much information concerning the function and morphology of the injured kidney.

We evaluated retrospectively 18 patients with blunt renal trauma and made an attempt to evaluate each radiographic examination in the staging of renal trauma.

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PATIENTS AND METHODS

We conducted a retrospective review of radiographic evaluation in 18 patients with blunt renal trauma, who presented to the National Defense Medical College Hospital from October 1977 to December 1987 and Self Defense Forces Hospital Yokosuka from June 1987 to June 1988. Sixteen patients were male and two were female. The age of the patients ranged from 8 to 52 years old. Six patients were less than 16 years old. The cause of injury was sports in 7 patients, automobile accidents in 4, and others in remaining 7.

Once renal injury was suspected, staging study was begun with a high-dose infusion pyelography. Fifty or 100 ml Urographine was injected intravenously. The film was obtained 10 to 30 minutes later. In the patient who was hemodynamically stable and whose IVP was not definitive, computerized tomography was carried out. When radiographic information substantially indicated continuous bleeding, angiography was immediately performed. We classified renal injuries into 3 categories (Fig. 1)[3]. 1) Minor parenchymal lacerations or contusions; these were subdivided into A-simple lacerations, B-

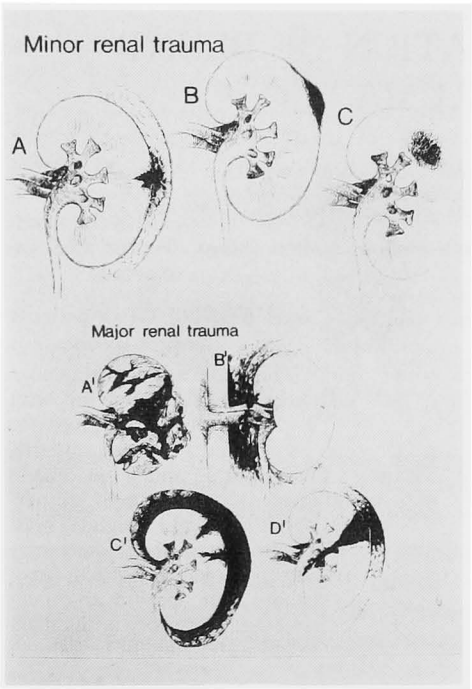

Fig. 1. Minor renal injuries. A, Simple laceration. B, Subcapsular hematoma. C, Renal contusion. Major renal injuries: A', Renal rupture. B', Laceration of renal artery and vein. C', Perirenal hematoma. D', Laceration through collecting system.

subcapsular hematoma and C-renal contusions: 2) major parenchymal lacerations. These were defined as lacerations through the corticomedullary junction. They often extended into the collecting system. Those with a perirenal hematoma were called C' and those with collecting system involvement were called D': 3) shattered kidney or renal pedicle injuries. These were subdivide into A'-ruptudred kidney and B'-laceration of the renal artery and vein.

RESULTS

The radiographic and operative findings indicated that, of 18 patients, 11 had a minor injury and seven had a major injury (Table 1). All patients with a minor injury and three patients with major injury could be managed conservatively. Four patients (22%) required surgical intervention. Of the seven patients with major injury four underwent surgery because of severe hemorrhage in three and urinoma in one.

Table 1. Classification and management of renal trauma

Treatment	Minor	Major	Total
Observation	11	3	14
Exploration	0	4	4
Total	11	7	18

Table 2. Correlation between IVP and CT findings of renal trauma

IVP	CT		
	Minor	Major	Total
No discernible injury	4	0	4
Poor visualization	3	5	8
Obliteration of psoas muscle	0	1	1

Fifteen patients with blunt renel trauma underwent a highdose IVP as the initial evaluation. CT scan was subsequently performed in 13 of the 15 patients. Four patients with normal IVP were confirmed to have minor renal injury by CT scan. CT scan was primarily performed in three patients who presented unstable blood pressure. Six patients with suspicious massive bleeding required further evaluations including an angiography.

Table 2 shows the comparison of the estimated stages by IVP and CT in 13 patients with blunt renal trauma. Poor visualization was the most common finding (61.5%) in the IVP. Three of eight patients with poorly visualized kidney had minor injury and five had major injury. All four patients with well-visualized and well-shaped IVP had minor renal injury.

We present radiograms of several patients with blunt renal trauma.

Case 1 : A 9-year-old girl had gross hematuria following an automobile accident. An IVP poorly visualized the right lower calices (Fig. 2a). However, CT scan only showed a minor laceration of the cortex with a subcapsular hematoma (Fig. 2b). She was successfully treated without surgical intervention. A follow-up CT scan taken one month later showed excellent healing of the damaged kidney (Fig. 2c).

Case 2: A 13-year-old boy had gross hematuria after an accident when he was

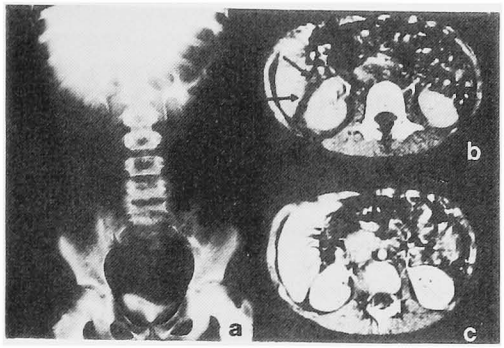

Fig. 2. a. IVP shows a poor visualized right lower calices.
b. CT scan demonstrates a minor laceration of the cortex with a subcapsular hematoma (arrows).
c. Patient was treated by observation and follow-up CT scan shows excellent healing.

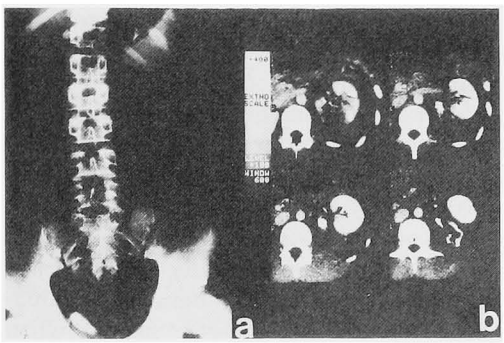

Fig. 3. a. IVP shows scoliosis and extravasation of contrast medium.
b. CT scan shows complete rupture of the left kidney and extravasation of contrast.

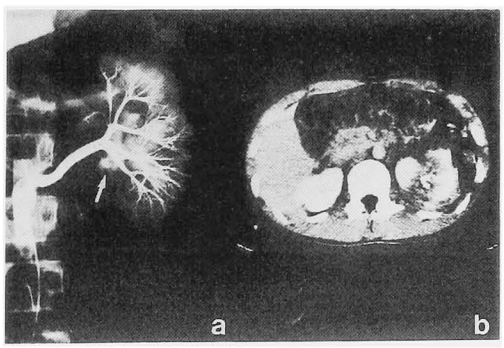

Fig. 4. a. Arteriograms from the same patient as in figure 3, revealed a fractured kidney and extravasation of contrast (arrow).
b. One month later, follow-up CT scan shows disappearance of the hematoma and no extravasation.

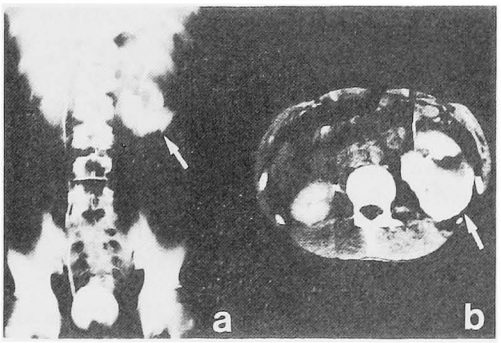

Fig. 5. a. IVP shows poor visualization of the left lower calyces and marked extravasation of contrast medium (arrow).
b. CT scan reveals a complete transection with extravasation of contrast from the renal pelvis (arrow).

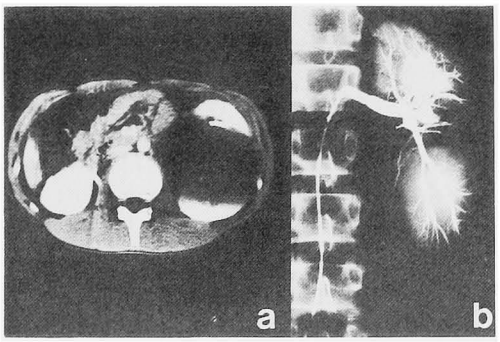

Fig. 6. a and b. Arteriogram and CT scan performed a month later reveal complete division of the renal parenchyma and a massive retroperitoneal urinoma.

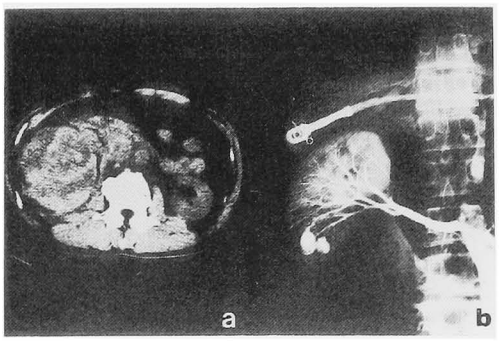

Fig. 7. a. CT scan demonstrates a massive retroperitoneal hematoma.
b. Arteriogram reveals extravasation from the distal renal artery.

playing volleyball. An IVP showed poor visualization of the left kidney, scoliosis and extravasation of contrast medium (Fig. 3a). A CT scan showed complete

rupture of the left kidney and extravasation of contrast (Fig. 3b). Renal arteriography revealed a fractured kidney and extravasation of contrast from the renal pelvis (Fig. 4a). However, arterial extravasation was not seen. Even though this patient had a major injury, he could be treated with careful observation and bed rest because he was hemodynamically stable.

One month later, a follow-up CT scan showed disappearance of the hematoma and no extravasation (Fig. 4b).

Case 3: A 14-year-old boy had gross hematuria after an automobile accident. The 10-minute film of IVP showed poor visualization of the left lower calyces and marked extravasation of contrast medium (Fig. 5a). CT scan revealed a complete transection with extravasation of contrast from the renal pelvis. A renal hematoma was also seen (Fig. 5b). There were no injuries in other organs and his physical condition was stable. Primarily this patient was conservatively treated with prophylactic antibiotics and bed rest. However, selective renal arteriography and CT scan performed a month later revealed complete division of the renal parenchyma and a massive retroperitoneal urinoma (Fig. 6a, 6b). Clinically he had persistent low grade fever which suggested an infected urinoma. Though a partial nephrectomy of the lower segment of the kidney was planned, the injured kidney had to be removed due to marked fibrosis around the kidney.

Case 4: A 41-year-old man fell from a 2.5 meter height and developed gross hematuria. A CT scan was performed soon after admission because of progressive anemia. It showed a massive retroperitoneal hematoma (Fig. 7a). A selective renal arteriography was immediately carried out to further define the source of bleeding. It demonstrated extravasation from the distal renal artery (Fig. 7b). The arterial extravasation was then controlled with selective transcatheter embolization. However, he again showed persistent hemorrhage, and the affected kidney was removed 24 hours later.

DISCUSSION

In general, the management of a renal injury should be selected according to its severity, and the success of treatment depends on the accurate staging of the injury. Inadequate staging of renal trauma may lead to needless morbidity and mortality due to incorrect or delayed surgical intervention.

It is controversial whether an IVP should be performed as an initial evaluation in patients with suspected renal injury after blunt abdominal trauma. The IVP is principally important to document the presence of a contralateral healthy kidney. However, in a standpoint of the staging, an IVP often failed to define the extent of injury in our series. Although it frequently (7/11) overestimated the trauma, poor visualization of the affected kidney in an IVP should be considered to require further radiographic evaluations. Especially, scoliosis or obliteration of the psoas muscle or extravasation strongly implied a major injury. On the other hand, all of four patients with a normal IVP had minor injuries and clinically insignificant. We consider further radiographic evaluation of the kidney is not required when the patient of blunt abdominal trauma has a normal IVP[4].

CT scan is a rapid noninvasive diagnostic method. CT scan has been increasingly used to differentiate minor from major injuries with an accuracy of more than 90%[5]. CT scan identified the extent of injury, perirenal hematoma, and associated retroperitoneal and abdominal trauma more precisely than did the pyelography. Enhancement by contrast medium gives an advantage in disclosing parenchymal laceration and extravasation. Recent reports[6,7] suggest that CT scan should be performed as a primary evaluation in patients with suspected sustaining major renal and other organ injuries.

The angiography is losing its advantages in the evaluation of the injury, almost replace it, but it still has some values, especially when renal surgery is intended. It is useful in patients with arterial injury.

It can demonstrate the site of arterial extravasation, and also rule out other visceral arterial injury.

CONCLUSIONS

We conducted a retrospective review of radiographic evaluation in 18 patients with blunt renal trauma in our institution.

Patients suspected of renal injury after blunt abdominal trauma should have an IVP as an initial evaluation. Further radiographic evaluation is not required when the IVP is normal. CT scan should be performed primarily or secondarily in patients suspected of sustaining major renal and/or other organ injuries.

Advantage of the angiography is limited to the patient with arterial injury which required surgical intervention.

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和文抄録

鈍的腎損傷の画像診断

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18名の鈍的腎損傷の患者における画像診断法の臨床的意義を検討した．患者は11名が minor injury で，7名が major injury であった．この内14名が保存的治療を，4名が手術的治療を受けた．静脈性腎盂造影は健側腎の存在が把握できるために有用であるが，しばしば損傷の範囲が不確かなことが多く，これは過大評価が多く，過小評価が稀な傾向を示した．CT エックス線検査は損傷の範囲，腎周囲血腫および併発する後腹膜や腹部外傷が，静脈性腎盂造影に比べ明らかに正確に診断された．血管造影は動脈性出血の部位を同定するのに有用であった．

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